USMC Corrosion Prevention and Control Program Newsletter

Issue 2 Winter 2010

Inside this issue:

Message from the Program Manager

Matthew Koch, Program Manager

Welcome to Issue 2 of the U.S. Marine Corps Corrosion Prevention and Control (CPAC) Newsletter. We received quite a bit of positive feedback from the first issue and hope to continue to bring you insightful and relevant information in the future.

As you will see inside, the CPAC Group has been very busy over the past year. Through the emerging elements program, CPAC has been on the lookout for areas to improve readiness and reduce corrosion related down-time. On the way for U.S. Marines and their support contractors is painter training from the STAR4D Program which will improve cost savings and reduce paint wastage while educating the painters and related personnel on issues such as safety and environmental hazards. We also have a program to review corrosion prevention products and materials (CPPMP) that takes your suggestions and puts them through rigorous testing and evaluation to ensure the Marine Corps is using the best tools for the job to prevent corrosion. Additionally, we are looking at chip resistant coatings to help keep vehicles free from paint damage while deployed, keeping them out of the maintenance depot and in active service.

Feedback is always welcome. Please contact the CPAC office (see page 8) with your comments and suggestions.

USMC Emerging Elements

By Anthony Meier, Defense Contractor

In keeping with the goals of its stated mission, the USMC Corrosion Prevention and Control Program (CPAC) Office is always on the lookout for new programs to improve readiness rates of equipment affected by corrosion. New leads for materials science solutions can be mandated by command, recommended by maintenance personnel, or extrapolated from data mining. CPAC utilizes these and other information sources to stay ahead of the problems as part of their Emerging Elements initiative.

As an early Emerging Elements initiative, the Total Ownership Cost Reduction (TOCR) program was used to identify corrosion related issues on new acquisition vehicles. A major component of TOCR tracked vehicle corrosion rates at six Marine Corps bases. Vehicles were visually inspected for signs of corrosion and the location and extent of damages were recorded. The collected data

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Emerging Elements

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was then analyzed for failure patterns, ultimately leading to the initiation of new projects designed to combat damages due to corrosion.

New ideas are also gathered from the field. Visits to Corrosion Rehabilitation Facilities (CRFs) provide insight from maintenance personnel on the front lines of the battle against corrosion. CPAC has also worked closely with Corrosion Service Teams (CSTs) to identify new processes being used in the field then test and standardize them for widespread use.

One of the latest tools designed to support the CPAC mission is the USMC Logistics Thrust system. This system uses data mining techniques to identify maintenance and readiness issues due to corrosion, erosion, and wear. It consists of a database of information about maintenance cost drivers along with an interface known as the Data Explorer. Together, they allow users to quickly and easily identify problematic systems and parts that constitute the leading causes of equipment downtime.

The USMC Logistics Thrust database is built from a collection of maintenance information management systems. These systems contain the most comprehensive records of equipment count, disbursement, and available maintenance and repair actions. Maintenance records provide information about failure and replacement rates of parts used on USMC vehicles and equipment. The Thrust Data Explorer allows for sorting and searching of this information based on a number of different metrics. Using this data, users can identify patterns of failure that may warrant further investigation.

Analysts have utilized a complex interaction of metrics to identify potential candidates for cause of failure analysis. The most appropriate candidates tend to be those exhibiting several of the following: above-average rates of failure and replacement, elevated order and ERO (equipment repair order) counts, low record counts and high extended prices and average costs per order. It was determined that groups of parts fitting these criteria had the most potential room for improvement.

Emerging Elements initiatives have been developed into several new projects for CPAC. Maintenance-level reports of failure, corroborated by data from the Thrust database, led to the undertaking of a root cause of failure analysis for automotive starters on High Mobility Multipurpose Wheeled Vehicles (HMMWV). CPAC engineers disassembled a sample starter motor that had been removed from an in-service vehicle due to seizing. Upon examination, it was found that moisture intrusion into the casing had caused a bearing to corrode, resulting in failure of the part to operate normally. Findings from this research could be used to produce starters that last longer by addressing the moisture intrusion or developing a more corrosion-resistant bearing.

The next step for the Emerging Elements program will be the administration of structured surveys to maintenance personnel within each Marine Expeditionary Force (MEF) and Marine Forces Reserve (MARFORRES). Interviews and information gathering conducted at multiple levels of maintenance will provide a more complete picture of the issues being dealt with in the field. In addition, inspection of specific types of parts, such as starters and alternators, may be able to shed new light on common mechanisms of failure. These improvements are only a few of those planned for the program, which has developed into an integral part of the CPAC toolkit.

STAR4D®, Painting with Laser Precision

By Ray Davidson, Marine Corps Logistics Command Albany, GA

With boots on the ground in Iraq and Afghanistan, the reality of war and the harsh terrain of the Middle East exacts its toll on the Marine and Joint War fighter and upon the equipment which their lives depend. For the Marine, the pinnacle of sustainment and readiness of his equipment is the Marine Corps Logistics Command with its supply chain and depot infrastructure.

It is the culture of innovation, pride in a job well done, and the knowledge that a Marine's life may well depend upon the rifle held in his hands, the vehicle upon which he rides, or the fire support needed to suppress the enemy that motivates the Marines, Sailors and Civilian Marines at the Logistics Command.

This culture of innovation is driven not only by a need to improve the Marines war fighting lethality and survivability but also as a conservator of the public's financial trust – taxpayer's dollars. The Civilian Marine wears well this mantle of efficiency and effectiveness – producing the best product for the least cost.

An example of innovation and cost efficiency is the Spray Technique Analysis and Research for Defense (STAR4D®) Program that is being utilized to apply CARC, Chemical Agent Resistant Coating.

CARC is required on all combat, combat support, and combat service support equipment. It is a polyurethane paint that provides superior durability, extends service life for military vehicles and equipment, provides surfaces with superior resistance to chemical warfare agent penetration, and greatly simplifies decontamination. In addition, it has an infrared signature that makes coated equipment harder to detect.

CARC was designed to counter the Soviet threat of chemical agents on the battlefield. The Soviets' goal was to inflict maximum casualties while temporarily contaminating an area. To counter this, the U. S. needed the ability to rapidly decontaminate personnel and their equipment. Thus,

STAR4D is being utilized to apply CARC, Chemical Agent Resistant Coating. CARC was designed to counter the Soviet threat of chemical agents on the battlefield.

CARC paint was engineered to prevent chemical impregnation and to aid in the rapid decontamination of equipment.

CARC, at the same time, is environmentally hazardous and expensive. Exposure to high concentrations of aerosolized CARC during spray painting leads to immediate respiratory irritation and watery eyes. Long-term exposure can cause or aggravate respiratory problems, in particular, asthma.

The environmental hazards of CARC and its high cost challenged the Marine Corps to seek an environmentally friendly and efficient application system that would ensure highest quality; that could be efficiently managed and maintained while keeping the equipment at the peak of mission readiness.

Responding to this challenge, the Marine Corps Depot with Maintenance Centers in Albany, Georgia and Barstow, California has partnered with the University of Northern Iowa in training their Civilian Marines in a new and innovative military refinishing technique. The chosen solution is the Spray Technique Analysis and Research for Defense (STAR4D®) Program.

Taught on the campus of the University of Northern Iowa (UNI) in Cedar Falls, Iowa, STAR4D exposed the Civilian Marines to advanced spray techniques and alternative technologies that improve coating applicators quality and, at the same time, reduce paint consumption, reduce waste and greatly decrease hazardous air emissions.

STAR4D focuses on overall knowledge of the entire painting process and improving spray techniques. With STAR4D employees are able to reduce the amount of harmful volatile organic compounds being released into the environment, the amount of paint wasted during application, and the time spent in the paint booth.

Currently the maintenance centers are experiencing a 40% transfer improvement efficiency with a 20% projected cost saving. We're talking about a savings of about 60 gallons of paint per year for every 300 gallons used. This can easily represent $200,000 in savings to the tax payer and most importantly, provide increased material

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STAR4D®, Painting with Laser Precision

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readiness for the Marine and Joint War fighter. The savings in time and money can then be reapplied to other weapon systems thus ensuring overall material readiness and survivability.

Commanding General, Marine Corps Logistics Command, acknowledges that flexible and sustainable maintenance is the key to future Marine Corps expeditionary and joint maneuver operations. Innovative maintenance solutions, such as STAR4D, demonstrate the fundamental tenets of the core value system that guides Marine Corps depot operations. The Marines, Sailors and Civilian Marines live every day that ethic of core values. They are unfaltering in that charge. Their resolute ensures that depot maintenance supports their "Soldiers of the Sea" efficiently and effectively, wherever their missions take them.

III MEF's Zinc-Rich Primer Program

MRAP Corrosion Makeovers

By Wayne McGaulley, Defense Contractor

In its April 10, 2009 issue, the *Okinawa Marine* reported the Corrosion Rehabilitation Facility (CRF) on Camp Kinser had used zinc-rich primer (ZRP) to re-preserve a Mine Resistant Ambush Protected (MRAP) vehicle. At the same time, the CRF painted the first MRAP with a green, brown, and black camouflage pattern, using the pattern from the P-19 Truck for the Cougar variant. The reason for using ZRP was that MRAPs were originally painted at the manufacturers' facilities for use in desert warfare. However, when moved to III Marine Expeditionary Force (MEF) locations for training purposes, those vehicles began to show significant signs of corrosion. In order to ensure a long life for those assets, Mr. William Antell, Director, Corrosion Prevention and Control for III MEF, along with Chris Ham, Lead Quality Assurance Specialist, and Rick Thomas decided to implement a program to use the zinc-rich primers on MRAPs, aptly called the ZRP Program.

Since the original article, the CRFs for III MEF have implemented a program to use ZRP on all steel equipment. To date, four MRAPs have received ZRP in the III MEF. In the near future, two vehicles from Camp Fuji will be rotated back to Okinawa for re-preservation and replaced with ZRP preserved assets. Eventually, III MEF plans to have all MRAPs re-preserved using ZRP to ensure adequate corrosion protection and long life. Vehicles preserved with ZRP have a "Z" stenciled on the equipment immediately after the Chemical Agent Resistant Coating (CARC) type.

It has been less than a year since the first vehicles were re-preserved with ZRP, however no corrosion has been observed during regular inspections. The first two MRAP vehicles to receive ZRP did not address a known issue with V-hull corrosion under the floorboards. This issue has been addressed by the III MEF CRF; removal of the floorboards to clean and treat the interior of the V-hulls has been added to the process.

First camouflage MRAP in the USMC painted by III MEF CRF.

When asked about a learning curve or difficulties using the ZRP, Mr. Antell stated "Painting is painting and trucks are trucks. The Okinawa CRF is pretty used to painting anything that comes their way." Mr. Ham stated that the only learning curve was the initial development of a checklist of items to remove from the MRAPs to ensure all areas are adequately preserved since no MRAP had been processed at the III MEF CRF before.

Corrosion Prevention Products and Materials Program

Evaluation and implementation of products and technologies to help lower costs and improve readiness

By Ryan Buchs, Defense Contractor

One of the main functions of the Corrosion Control and Prevention (CPAC) Office is to improve maintenance and reliability of new and existing vehicle platforms and structures throughout the U.S. Marine Corps. A major component of this function is the evaluation and implementation of corrosion technologies and products which are new to the organization. These corrosion technologies could be found existing in different commercial, industrial, or military applications, or be completely new to the entire corrosion industry. The transition process of these products into the USMC is performed by the Corrosion Prevention Products and Materials Program (CPPMP).

CPPMP outlines the procedure of authorizing promising technologies and products based on the requirements of the various end-users of corrosion control products and materials in the Marine Corps. The design of CPPMP allows for continuous comparison of currently approved products to those under consideration; ensuring CPAC utilizes the best corrosion tools for their specific uses. The process of implementing new technologies is done in five main steps: obtain, identify, hazard, test, and authorize.

Obtain: CPAC takes submissions of the needs of end-users and obtains existing or new products and technologies in the Marine Corps. This step is designed to allow for rapid response to requests for product evaluations. In order to consider new additions to the authorized product list, intrinsic properties of the product (e.g. cost, color, strength) will be reviewed to ensure that they meet current USMC requirements.

Identify: The designation of the function of products is necessary for the consideration of required performance properties. These designations are not concrete; product uses could change depending on laboratory and field testing, or even after long-term use.

Hazard: Hazard identification is a crucial step in the CPPMP process. Corrosion products are often used or applied in close proximity to people. Also, it is not uncommon to find products or processes which pose environmental hazards. For this reason, full disclosure of each component and their hazards are required to be submitted. From this information, proper Personal Protective Equipment (PPE) and disposal procedures can be written.

Test: Laboratory testing evaluates submitted products by comparison to existing Marine Corps' products. Applicable testing procedures are created or obtained based on their designated use determined in the identification step. These testing procedures involve characterizing physical, corrosion, and compatibility properties, as well as developing application techniques where they are needed. Depending on the results of the study, field testing is performed on vehicle platforms or structures. Once the product has been evaluated and deemed acceptable for use within the Marine Corps, it is then submitted for authorization.

Authorize: Authorization of products is dependent on the type of product being submitted. Products can be subject to regulations and circumstantial stipulations if they are not easily utilized with the capabilities of the Corrosion Service Teams (CSTs) and Corrosion Repair Facilities (CRFs).

Some examples of CPPMP in action are: evaluating a new tool in the CPAC CST toolkit, and compatibility testing of High Mobility Multipurpose Wheeled Vehicle (HMMWV) materials and standard Corrosion Preventative Compounds (CPCs).

Immersion testing of HMMWV parts to determine CPC compatibility.

The new tool submitted for evaluation was a rotary bristle brush which combines the functions of a rotary disc grinder and a needle gun. The tool was being field tested in Camp Lejeune by their CST for any unfore-

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Chip and Abrasion Resistant Materials

Now Available at Corrosion Repair Facilities and Depots

By John Repp, Defense Contractor

The USMC Corrosion Prevention and Control (CPAC) Program strives to incorporate coating and corrosion technologies into vehicle maintenance and repair activities that decrease the deterioration of ground weapon systems. With this in mind, on September 17, 2009, the CPAC Program Manager authorized the use of two general classes of chip and abrasion resistant materials: (1) Polyurethane-based coatings (per Commercial Item Description (CID) A-A-59719), and (2) Polyurea-based coatings (per CID A-A -59800). These are both high build, plural component coating technologies similar to the spray-on bed-liners popular in pickup trucks.

These materials offer two main benefits: they provide improved mechanical/abrasion resistance as compared to a standard Chemical Agent Resistant Coating (CARC) system, and they provide a thick barrier offering corrosion resistance and electrical isolation (prevention of galvanic corrosion). It is these properties that make them an excellent supplement to the CARC system in cargo areas, wear areas and other locations on a vehicle that are prone to abrasion and wear from normal use.

Challenges exist with the application of these materials. First, specialized equipment is needed due to the rapid cure of the coating (nominally less than 5 minutes). This requires a capital investment by the Corrosion Repair Facility (CRF) or Depot. Another challenge is the surface preparation required prior to application. These materials do not adhere well to smooth metal surfaces and require either a pre-treatment or primer (preferred) such as a zinc-rich coating (per CID A-A-59745) or epoxy coating (per MIL-P-53022 or MIL-P-53030). The CRFs and Depots, having recognized these materials' value in improving the corrosion resistance of USMC assets, are making the necessary investments in equipment and training to ensure the successful application of these coatings.

Color-tinted abrasion resistant coating applied to trailer bed .

The final and largest challenge facing widespread use of these materials is specification of their use in the statement of work (SOW) for vehicle repair. Unless the Program Manager (PM), Marine Expeditionary Force (MEF) or owning organization requests their application, these materials will not see widespread use and their benefits will not be fully realized. Working towards having chip and abrasion resistant materials applied to all appropriate assets, the CPAC Program Office continues to brief PMs and MEFs about the benefits of these materials.

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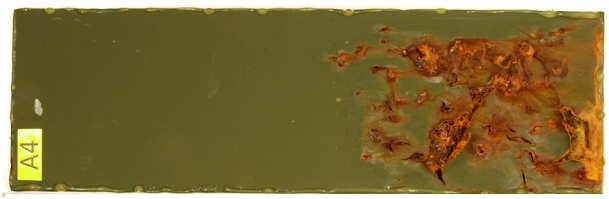

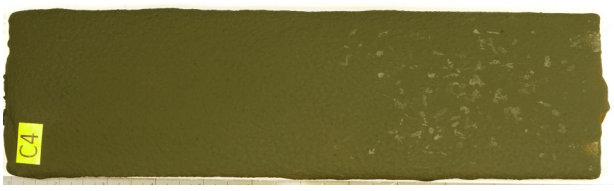

Chip Resistance Comparison
CARC Control (A4, left), CARC over Abrasion Resistant Coating (C4, right)

Corrosion Prevention Products and Materials Program

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seen uses or issues. Laboratory testing focused on measuring the stripping rate and the resulting surface profile, as well as determining the effects of requested modifications as a result of the field testing. The performance and surface profile were compared to a rotary disc grinder similar to the one in the toolkit. Techniques for proper usage were also determined based on manufacturer consultation and lab testing.

Compatibility testing is currently being performed after reports of detrimental effects of CPCs with some parts on HMMWVs. Six CPCs are chosen based on being either the most common or having the harshest chemistries. Testing is performed on fabrics, rubber linings, adhesives, and plastics found in a standard HMMWV. Specimens are cut from bulk material samples

Tensile testing of HMMWV fabrics.

or directly from the parts. After immersion in the different CPCs, the specimens are then tested for tensile and shear strength, hardness, swelling, and visually examined. Limitations and requirements of the CPCs on different parts will be issued to the CSTs and CRFs based on testing results.

As seen, CPPMP involves a wide range of evaluations depending on the needs of the end-users. The program is flexible enough to perform any necessary laboratory or field evaluation and strong enough to issue procedures and requirements for products and techniques. With CPPMP, corrosion prevention and control can be implemented while maintaining asset integrity, improving readiness, and efficiently managing costs of the Marine Corps.

Chip and Abrasion Resistant Materials

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Despite these challenges, these materials have been applied on some systems and parts. This past summer, the II MEF CRF team carried out demonstrations of both materials on cargo beds of trailers (which were scheduled for disposal) for purposes of personnel training and testing by CPAC. During these demonstrations, they also applied these materials to mine-clearing hooks and High Mobility Multipurpose Wheeled Vehicle (HMMWV) up-armor panels (mating face only). The Depot at Marine Corps Logistics Command Albany, GA is also performing application of these materials to the floor of a mobile trauma bay. This application presented a unique challenge in that the material was applied directly over the surgical stainless steel floor, requiring the application of an adhesion promoter.

"The final and largest challenge facing widespread use of these materials is specification of their use in the statement of work (SOW) for vehicle repair."

Chip and abrasion resistant coatings are being incorporated into fixed and mobile CRFs and Depots throughout the USMC. Having these coatings applied to USMC systems is projected to have significant corrosion and cost-savings benefits and as these requirements are placed into SOWs these organizations are ready to respond.

Abrasion resistant coating applied to HMMWV armor panel.

Parting Shots

In the next issue:

* ***Helpful Hints on Applying CPCs***
* ***Can appliqué materials reduce corrosion and wear on Marine Corps vehicles?***

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Marine Corps Systems Command

The Corrosion Prevention and Control (CPAC) program resides under the authority of the Marine Corps Systems Command (MARCORSYSCOM), the Commandant of the Marine Corp's principal agent for acquisition and sustainment of systems and equipment used by the operating forces to accomplish their war fighting mission.

USMC Corrosion Prevention and Control

Marine Corps Order 4790.18B directed the creation of the Corrosion Prevention and Control (CPAC) program. The program's objectives are to treat and prevent corrosion on existing assets, to implement corrosion control in the design stage of new procurements, and to research and develop corrosion prevention products, materials, technologies and processes.

For more information, contact:
CPAC Program Manager: (703) 432-6165
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Online Resources

CPAC Website:
http://www.marcorsyscom.usmc.mil/cpac/default.asp

Department of Defense Corrosion Policy Office Website: http://www.corrdefense.org

2010 CPAC Working Group Conference

Date: May 11-13, 2010
Location: MCB Kaneohe Bay, HI

For more information concerning this or any previous conference, please visit our website: http://www.marcorsyscom.usmc.mil/cpac/meetings.asp.

News and Events

OSD Conference

In August 2009, the Corrosion Prevention and Control (CPAC) Engineering Group hosted a booth at the Office of the Secretary of Defense (OSD) Corrosion Conference. The booth was well attended and brought significant attention to the program. Additionally, the CPAC Engineering Group presented topics including a "USMC CPAC Program Overview" and "An overview of Applied Research and Testing for the Corrosion Control of USMC Ground Weapon Systems"

Other News

Crash Rescue Equipment Services (CRES) reported coating failure of the Chemical Agent Resistant Coating (CARC) topcoat on their Fire Suppression Systems (FSS). After inspection of the failed parts, the Corrosion Prevention and Control (CPAC) Engineering Group determined that the failure was caused by improper surface treatment and the use of a primer not compatible with the CARC topcoat. CPAC recommended that the contract be modified to include surface pretreatment and proper primer application